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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/944,186	09/04/2001	Atsushi Yamaguchi	PF-2871	1202

466 7590 02/23/2004

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EXAMINER	
HU, SHOUXIANG	
ART UNIT	**PAPER NUMBER**
2811	

DATE MAILED: 02/23/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/944,186	YAMAGUCHI ET AL.	
	Examiner	Art Unit	
	Shouxiang Hu	2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 December 2003*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *71,75-80 and 121-128* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *71,75-80 and 121-128* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *08 December 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 20030626
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. The drawings are objected to because:

The term of Eg fluctuation" in Figs. 7 and 8 should read as: --standard deviation of Eg fluctuation--, according to the specification (see page 44, lines 7-10).

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

The disclosure is further objected to because of numerous informalities and/or defects, which include but not limited to:

2. On page 12, lines 17-19, the description therein regarding Fig. 7, is not consistent with what is really shown in Fig. 7.

3. On page 56, lines 4-6, the hatched region appears to represent the second type semiconductor laser device for high output performance.

4. In addition, the two paragraphs both starting with "Fig. 16" on pages 55 and 56, respectively, appears to contain unnecessarily repeating contents.

Thorough proof reading and appropriate correction are required.

Claim Objections

5. Claims 71, 75-80 and 121-128 are objected to because of the following informalities and/or defects:

In claim 71, the term of "than of 40 meV" should read as: --than 40 meV--.

In claims 126-128, the term of "said substrate" lacks a sufficient antecedent basis.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 71, 76, 77, 79, 121, 124, 125 and 127 are rejected under 35 U.S.C. 102(e) as being anticipated by Domen et al. ("Domen"; US 6,555,403).

Domen discloses a semiconductor device having a semiconductor multi-layer structure (particularly see Figs. 5 and 19-20, and col. 24, lines 34-40, col. 25, lines 45-50, col. 26, line 2, through col. 27, line 64, and col. 63, lines 23-24), comprising an active layer (16) having a quantum well ($In_{0.5}Ga_{0.85}N$) as part of a luminescent layer (an $In_xAl_yGa_{1-x-y}N$ layer, with y=0, which naturally functions as a quantum well), wherein a

threshold mode gain of the single quantum well can be more than 12 cm^{-1} (see G_{th} in Fig. 19; also see "MODEAL GAIN" in Fig. 5). And, Domen further discloses that the band gap fluctuation (through photo-luminescence peak wavelength distribution) for the active layer is less than 20 meV (col. 25, lines 53-55), or even as low as 5 meV (col. 24, lines 34-40). Accordingly, the photo-luminescence peak wavelength distribution for the active layer in Domen can be far less than the 40 meV as recited in the instant invention, and even much lower than the 17 meV provided in the best mode of the instant invention (see page 82, lines 22 and 23). Therefore, both the microscopic and macroscopic fluctuations in the luminescent layer in Domen are not more than 40 meV, because: (A) the band gap energy fluctuation in Domen is measured at spots of 1 micrometer in diameter (col. 24, lines 10-17), the macroscopic band gap energy fluctuation (at spots a little bit larger than 1 micron) and the microscopic band gap energy fluctuation (at spots a little bit less than 1 micron) are then naturally still no more than 40 meV, given the much smaller fluctuation magnitude measured at 1-micron spots in Domen; and/or the microscopic fluctuation is naturally no larger than 40 meV when the macroscopic fluctuation is smaller than 40 meV and the threshold mode gain of the single quantum well is more than 12 cm^{-1} (according to the inherent relationships among them as shown in Figs. 16 and 17 of the instant invention).

In addition, the differential gain (dg/dn) in Domen can be naturally no less than 10^{-20} (m^2), according to the inherent relationship between the differential gain and the microscopic fluctuation shown in Fig. 10 of the instant invention.

Regarding claims 79 and 127, Domen further discloses that the substrate can be sapphire (col. 63, lines 23-24).

Regarding claim 121, the microscopic indium composition fluctuation in Domen is naturally no more than 0.067, according to the inherent relationship between it and the microscopic band-gap energy fluctuation (as shown in page 50, line 11, of the instant invention), when the microscopic bad-gap energy fluctuation is no more than 40 meV.

Regarding claim 124, the recited relationship between the internal loss and the mirror loss can be naturally met in Domen, provided that the threshold mode gain (which by definition equals to the sum of the internal loss and the mirror loss) of the single quantum well is more than 12 cm^{-1}.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 75, 78, 80, 122, 123, 126, and 128 are rejected under 35 U.S.C. 103(a) as being unpatentable over Domen et al. ("Domen"; US 6,555,403) in view of Razeghi (US 6,455,090) and/or applicant's admitted prior art ("AAPA").

The disclosure of Domen is discussed as applied to claims 71, 76, 77, 79, 121, 124, 125 and 127 above.

Domen does not expressly disclose that the semiconductor laser device can have a cavity length "L" of not less than 1000 micrometers, that the reflectance of the first facet is not more than 20%, and the reflectance of the second facet is not less than 80% and less than 100%; and that the substrate can also be GaN. However, one of ordinary skill in the art would readily recognize that longer cavity length can desirably reduce the threshold current density and increase the output, as evidenced in Razeghi (see Fig. 6, in which the cavity length can be larger than 1 mm); that one of the facets can be desirably coated to have a high reflectance in order to reduce the threshold current density in the laser and increase the optical output from the uncoated output facet, as evidenced AAPA (see page 6, line 21, through page 7, line 1; in which the coated facet has a reflectance of 95%. And, it is noted that the uncoated facet would inherently have a reflectance of less than 20% (see page 70, lines 3-14, in the instant specification)); and that the GaN–based multiple layers can be directed formed on a GaN substrate for better lattice match therebetween, as also evidenced in AAPA (see the GaN substrate 121 in Fig. 2).

Therefore, it would have been obvious to one of ordinary skill in the art t the time the invention was made to incorporate the above-1-mm cavity length of Razeghi and the single-facet coated mirror and the GaN substrate of AAPA into the semiconductor laser device of Domen, so that a laser device with reduced threshold current density, improved optical output and reduced defects in the active layer would be obtained.

Regarding claims 75, 122 and 123, the recited limitations for the slope efficiency would be naturally met in the above collectively taught laser device, since the

reflectances of the paired facets and the cavity length (they together also determines the mirror loss) in the above collectively taught laser device would be substantially the same as that in the instant invention.

Regarding claims 80 and 128, it is noted that it is art-recognized that low surface dislocation density in the substrate is very critical for the epitaxial growth of high quality multiple GaN-based layers; and that a surface dislocation density of lower than $10^8/cm^2$ can be readily achieved for a GaN substrate, since even in a derived GaN substrate the surface dislocation density can be already as low as about $10^6/cm^2$ or lower (as evidenced in the prior art such as Tsuda et al., US 6,294,440; see col. 2, lines 25-29).

Response to Arguments

8. Applicant's arguments filed on 12-08-03 have been fully considered but they are not persuasive.

Applicant's main arguments include: (A) Domen does not teach that the microscopic fluctuation is less than 40 meV; (B) Domen does teach the measurement of the photo-luminescence life-time; and (C) The length of the cavity in Domen is 700 microns, which is less than the 1000 micron recited in the instant invention.

With respect to arguments A and B above, it is noted that both the microscopic and macroscopic fluctuations in the luminescent layer can be naturally no more than 40 meV, because: (A) the band gap energy fluctuation in Domen is measured at spots of 1 micrometer in diameter (col. 24, lines 10-17), the macroscopic band gap energy fluctuation (at spots a little bit larger than 1 micron) and the microscopic band gap

energy fluctuation (at spots a little bit less than 1 micron) are naturally still no more than 40 meV, as the fluctuation magnitude measured at 1-micron spots in Domen can be much smaller than 40 meV; and/or, according to the inherent relationships shown in Figs. 16 and 17 of the instant invention, the microscopic fluctuation is naturally no larger than 40 meV when the macroscopic fluctuation is smaller than 40 meV and the threshold mode gain of the single quantum well is more than 12 cm^{-1}.

Regarding argument B above, it is further noted that In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the feature upon which applicant relies (i.e., the measurement of the photo-luminescence life-time) is not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Furthermore, even with limitations regarding such feature being directed recited in the claims, such limitation would be regarded as process limitations, and they would not carry patentable weight in this claims drawing to a structure, because distinct structure is not necessarily produced. In re Thorpe, 227 USPQ 964, 966 (Fed. Cir. 1985).

Regarding argument C above, although Domen does not expressly disclose that the cavity length "L" can be no less than 1000 micrometers, it is noted the cavity length in a laser is in an art-recognized result-effective parameter of importance subject to routine experimentation and optimization; and that the recited micrometer range is well within the art-recognized normal range for the cavity length, as evidenced in Razeghi. Such routine experimentation and optimization would be well with the ordinary skill in

the art, as it has been held that "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Conclusion

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shouxiang Hu whose telephone number is 571-272-1665. The examiner can normally be reached on Monday through Thursday, 7:30 AM to 3:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C. Lee can be reached on 571-272-1732. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

SH
February 19, 2004 Shouwang Hsu